Seed Storage in Soils of Several Victorian Plant Communities

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If favourable conditions are provided, the surface soil may yield a remarkable density and variety of seedlings. The fate of seed falling on the soil surface can be of great importance to the continuity of vegetation on a given site. Seeds may enter the soil by falling down cracks opened in dry weather, by burial in earthworm casts, by ant harvesting or the activity of lyre-birds, rabbits, bandicoots, etc. They may be unable to germinate on moistening because of environmental limitations such as high CO_2 and low O_2 concentrations, the absence of light, or the existence of temperatures too low or too steady. In addition, the physiological condition of the embryo, or the impervious nature or toughness of the seed coat may prevent germination. The conditions required for the germination of even individual seeds of a species vary tremendously, and in the natural environment dormancy and induced dormancy serve to distribute the species over long periods of time.

Ewart (1908) classified seeds on their longevity as:

Microbiotic—with viability of less than 3 years

Mesobiotic—with viability of 3-15 years

Macrobiotic—with viability of 15 to over 100 years.

The seeds of some exceptional species, notably of the order Leguminosae (*Albizzia, Acacia, Hovea* and *Goodia*), are viable after 100-147 years, whilst the oldest authentic viable seeds are those of the lotus (*Nelumbium*), which were germinated after 237 years (Godwin and Willis, 1964).

Generally one may expect a high density of seeds in the surface layers of the soil and a progressive diminution with depth. The species composition of deeply buried seeds may or may not reflect the composition of the present vegetation growing on or near the site. This is due to seasonal or yearly fluctuations of species and seed production, variable longevity of seed, and destruction of seed by animals. Seeds that are buried usually do not germinate till by some accident they are returned to the soil surface or near to it.

Method

Pairs of students collected exactly one square foot of soil (except in the Mallee) at depths of 0-2 inches and 2-4 inches from six sites in chosen vegetation types in early March. A general treatment of stratification* at 2°C for one month was carried out and the soil then sieved of rocks, roots, rhizomes, corms and tubers. Only a proportion of the total fresh weight of the soil was used to provide a 2 inch layer over the seed-free sand in the 8 inch test pots. In early April, the experiment was set up in a heated

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glasshouse, so as to obtain as much germination as possible. Considerable thinning of seedlings was often necessary before identification could be made, and although transplants were catalogued, difficulties were such as to necessitate the lumping together of some closely related species or genera, e.g. *Monotoca* and *Leucopogon*.

Between April and October the daily maximum and minimum temperatures in the glasshouse varied from 70-90°F and 60-65°F respectively and the number of hours over which higher temperatures were sustained increased with the hours of daylight. Soil temperatures, measured on two afternoons with thermocouples, were only 1-2°C higher than the air temperatures. The germination results were calculated as seedlings germinated per square foot of soil at depths of 0-2″ and 2-4″. This was done by multiplying the number counted by the proportion of total soil weight collected to soil weight used in the test. Although great care was taken, it is possible that some field contamination of the lower layer occurred after removal of the top layer in the lighter and drier soils.

Results and Conclusions

The results summarized in table 1 show that the number of seeds in the surface soils under native vegetation can be enormous. Very high seed numbers in surface soil for pasture in England (Harper 1960) equal those of the grassy woodlands of this study. The most rapid germination occurred in the soils from the drier environments, such as the mallee and grassy woodlands, whilst the slowest occurred in the soils from the heath and the wet forests. This may reflect the relative length of time normally available for germination in these areas. The species varied in their rates of germination, resulting in flushes of seedlings; grasses in general were early, and rushes and sedges late. A brief burst of germination occurred in August when all soils were turned over to expose underlying seeds to light and better aeration.

Interesting differences in the rate of germination and flowering occurred in some species. In the woodland soils for example, *Agrostis avenacea* and *Aira caryophyllea* appeared and developed more quickly in the Chiltern soil than in the Yan Yean soil. This could be due either to the direct effect of the soil or to some adaptive response by the species to the climate of the original site. The development of mosses, liverworts and ferns from spores was slow but often dense. It was interesting to note the development of Bracken from a prothallus in the *Nothofagus* soil, and the surprising lack of tree ferns from the *Eucalyptus regnans soil**.

The rock fern (*Cheilanthes tenuifolia*) occurred in all the woodland soils and was absent from the heath, mallee and wet forests soils. The bryophyte flora was a restricted one, and contaminants from the glasshouse were disregarded. The abundance of *Pogonatum* in the *Nothofagus* soil and the thallose liverworts *Riccia* and *Anthoceros* in the mallee soils were of great interest.

There was a general tendency for soil seed to increase in abundance from the friable soils of the wet forests to the gravelly and clay soils of the woodlands, and to decrease again in the sandy soils of the mallee and heath. However considerable variation occurs from site to site in each

* Stratification is the storage of moistened seed at temperatures between 0 deg. and 10 deg.C.

* The prothalli of these have been obtained in great abundance from such soils from Wallaby Creek (D. H. Ashton).

vegetation type, and further collections at different times of the year are necessary. More sophisticated treatments are also needed to ensure that all seed germinates. The germination rates of all species, except for some in the Red Gum woodlands, had fallen to a very low value by October. It is well known however, that several years are necessary to germinate all seed present in the soil, and that diminished peaks of germination occur in successive years (Thurston 1960). Because the species assemblages in the soils were in general distinct or as expected from the botanical description of the sites, it is felt that very little contamination occurred during the experiment. However light mobile seed such as *Sonchus, Erigeron* and *Senecio* are somewhat suspect, since Silver Birch seed did in fact blow into the glasshouse in windy periods.

Important members of many communities such as *Eucalyptus, Atherosperma, Callitris* and the Proteaceae are conspicuous by their absence. The major distinction between the surface and sub-surface soils lies in the number of seeds germinating. The most notable difference in species composition is the restriction of the few Eucalypts to the surface layer. This is in agreement with the view that there is little or no soil storage of Eucalypt seed (Ashton, 1955).

Many of the species listed in the following table are herbs and grasses, some of them having quite minute seeds. It is likely that in some soils their accumulated weight may make a significant contribution to any chemical assessment of soil fertility.

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Appendix

Description of vegetation sites and germination results.

Myrtle Beech Forest—Mt. Victoria, Cement Creek.

(Workers: A. Sebire and H. Kosmer)

Soil was collected from the forest on a southerly aspect of a gully on the slopes of Mt. Victoria at an altitude about 2,000 ft.

The soil was a deep friable brown loam (similar to a krasnozem) on a dacite bedrock. Lyrebird activity in the surface layers was well in evidence.

The vegetation at this site was a mature beech forest 60-70 ft. high with a tall surrounding overstory of *Eucalyptus regnans*. Tree species were Myrtle beech (*Nothofagus cunninghamii*), *Atherosperma, Acacia melanoxylon* and *Hedycarya* with *Dicksonia* and *Coprosma* forming an uneven understory. The ground stratum of *Australina, Clematis* and *Blechnum procerum* was patchy. Lianes such as *Parsonia straminea* were present.

SOIL SEED 1964 (Collected March, 1964, set up April 1964, terminated October 1964)

Vegetation	Rainfall	Locality	Soil type	Parent rock	Seedlings/sq. foot 0-2″	2-4″	0-4″ (total)	Ratio 0-2/2-4	Percentage growth forms: trees	shrubs	climbers	dicot herbs	monocot herbs	Workers
Myrtle beech forest	±60″	Cement Creek	brown friable loam	dacite	120	94	214	1·28	52·0	3·6	2·7	39·9	1·8	Kosmer and Sebire
Mountain ash forest (wet sclerophyll forest)	±51″	Kallista	red friable loam	dacite	60	80	140	0·75	12·6	5·9	3·5	73·4	4·3	Cross and Benson
Messmate stringybark forest	±47″	Kinglake National Park	red to grey friable loam	mudstone	WSF 243	75	318	3·24	2·3	26·9	0·3	57·2	13·3	Carroll and Hope
(wet sclerophyll forest)					152	50	202	3·04	0	58·7	0	31·7	9·6	
(dry sclerophyll forest)					DSF 92	34	126	2·71	1·1	42·8	0·1	44·4	11·4	
Dry sclerophyll forest *E. tereticornis* *E. macrorhyncha*	±25″	Chiltern	gravelly loam	granite	1143	220	1363	5·20	0·03	0·03	0	44·5	55·4	Canning and Boer
Savannah woodland *E. camaldulensis*	±27″	Yan Yean	grey clay	basalt	2303	548	2851	4·20	0	0	0	24·7	75·3	Ingerswen and Webb
Savannah woodland *E. camaldulensis*	±22″	You Yangs	gravelly loam (granite outwash)	granite	2953	378	3331	7·81	0	0·3	0	33·0	66·7	Lawson and Smith
Mallee *E. oleosa—Callitris*	±11″	Mildura	red loamy sand	sand hills	422	150	572	2·81	0	5·4	0	83·7	10·8	Groot Obbink and Zee
Heath *Leptospermum myrsinoides*	±28″	Cranbourne	grey and yellow sands	sand hills	36	26	62	1·38	0	39·4	0	33·1	27·5	Zammit and Ridgway

Results:

0-2": 120 seedlings/square foot.

Composition %: *Hedycarya angustifolia* 51·0%, *Australina muelleri* 36·8%, *Tieghemopanax sambucifolius* 2·5%, *Carex appressa* 2·5%, 2% (*Clematis aristata, Cirsium* sp., *Oxalis corniculata, Nothofagus cunninghamii, E. regnans, Gnaphalium purpureum*).

2-4": 94 seedlings/square foot.

Composition %: *Hedycarya* 50·3%, *Australina* 35·3%, *Clematis* 3·7%, *Tieghemopanax* 3·6%, *Senecio* sp. 2·1%, <2% (*Cirsium, Carex appressa, Acacia melanoxylon, Cassinia aculeata*).

Ferns: *Histiopteris incisa, Hypolepis punctata, Pteridium esculentum.*

Bryophytes: *Pogonatum subulatum, Funaria hygrometrica, Funaria gracilis, Fissidens leptocladus, Chiloschyphus* sp.

Mountain Ash Forest—Kallista.

(Workers: G. J. Cross and A. D. Benson)

Soils were collected from a steep easterly slope at an altitude about 1,000 ft. The soil type was a deep brown friable loam of the krasnozem type developed on dacite.

The vegetation was wet sclerophyll forest dominated by Mountain Ash (*E. regnans*). There was an understory of *Acacia dealbata* and *A. melanoxylon* with a more or less continuous shrub layer of *Pomaderris, Olearia, Bedfordia, Cassinia, Dicksonia* and *Cyathea*. The climbers *Clematis* and *Billardiera* were also present. The field layer was for the most part patchy with *Tetrarrhena, Histiopteris, Pteridium, Polystichum* and *Australina*. Lyrebird activity was much in evidence and the first few inches of soil were greatly disturbed. Soils of the lower level were more compact than those of the upper level.

Results:

0-2": 60 seedlings/square foot.

Composition %: *Hydrocotyle geraniafolia* 20·5%, *Galium* sp. 17·5%, *Olearia argophylla* 14·6%, *Oxalis corniculata* 9·6%, *Gnaphalium japonicum* 5·1%, *Cardamine dictyosperma* 4·7%, *E. regnans* 4·2%, *Stellaria flaccida* 4·2%, *Acaena anserinifolia* 3·4%, *Veronica notabilis* 3·0%, *Tetrarrhena juncea* 2·9%. <2% (*Rubus fruticosus, Juncus* sp., *Australina muelleri, Bedfordia salicina, Clematis aristata, Gnaphalium purpureum, Senecio quadridentatus, Cerastium* sp., *Acacia dealbata, Cassinia aculeata, Leycesteria formosa*).

2-4": 80 seedlings/square foot.

Composition %: *Hydrocotyle geraniafolia* 31·3%, *Galium* sp. 22·8%, *Oxalis corniculata* 10·0%, *Olearia argophylla* 4·8%, *Juncus* sp. 4·2%, *Solanum xanthocarpum* 3·2%, *Festuca dives* 2·7%, *Pomaderris aspera* 2·4% (=*Pomaderris apetala*). <2% (*Stellaria flaccida, Gnaphalium japonicum, Cassinia, Tetrarrhena, Clematis, Australina, Erigeron* sp., *Cardamine dictyosperma, Rubus fruticosus, Geranium pilosum, Hydrocotyle hirta, Centaurium australis, Pimelea axiflora, Anagallis arvensis, Senecio quadridentatus, Solanum nigrum*).

Ferns: *Histiopteris incisa, Hypolepis punctata, Culcita dubia*

Bryophytes: *Funaria gracilis*

Messmate Forest—Kinglake National Park.

(Workers: Elizabeth J. Carroll and G. S. Hope)

Soil was collected from several sites in the Kinglake National Park. The sites were not well chosen as three types of vegetation were represented; wet sclerophyll forest, dry sclerophyll

forest and tall woodland. The sites ranged in altitude between 1400 ft. and 1800 ft.

Wet sclerophyll forest:

This vegetation was present on two sites. The standing vegetation was dominated by Messmate (*E. obliqua*) and Mountain Grey Gum (*E. cypellocarpa* re *E. goniocalyx* of Ewart, Blakeley). There was an understory of *Acacia dealbata, Bedfordia* and *Pomaderris*. The forest floor was unusually grassy for a wet sclerophyll forest with *Poa australis* and *Tetrarrhena* as the most prominent grasses. The ground stratum was semi-continuous and contained *Viola hederacea, Halorrhagis tetragyna* and *Brachycome multifida* as well as the grasses.

The soils of the area are grey to red friable loams developed on Silurian mudstone and there is apparently little disturbance of the surface soils.

Results:

0-2": 243 seedlings/square foot.

Composition %: *Cassinia aculeata* 19·3%, *Halorrhagis tetragyna* 15·6%, *Viola hederacea* 8·5%, *Cerastium* sp. 8·1%, *Centaurium australis* 6·5%, *Pomaderris aspera* (*apetala*) 4·7%, *Gnaphalium japonicum* 4·5%, *Deyeuxia* sp. 4·5%, *Bedfordia salicina* 4·5%, *Juncus* sp. (perennial) 4·2%, *Goodenia ovata* 3·2%, *Brachycome multifida* 3·2%, *Oxalis corniculata* 3·2%, *Luzula campestris* 2·4%. <2% (*Helichrysum ferrugineum, Wahlenbergia gracilis, Argostis avenacea, Sonchus oleraceus, Senecio arguta, Sagina apetala, Billardiera scandens.*)

2-4": 75 seedlings/square foot.

Composition %: *Cassinia* 21·5%, *Viola* 18·5%, *Centaurium* 16·4%, *Halorrhagis* 10·8%, *Juncus* sp. (perennial) 6·2%, *Gnaphalium* 5·9%, *Luzula* 4·1%, *Deyeuxia* sp. 3·5%, *Erigeron canadensis* 2·1%, *Geranium pilosum* 2·1%. <2% (*Oxalis, Brachycome, Wahlenbergia, Prostanthera lasianthos, Pimelea* sp.)

Dry sclerophyll forest:

This vegetation was present on three sites. Standing vegetation was dominated by *E. obliqua* and *E. radiata* with an underscrub of sclerophyllous shrubs and bracken. Main shrub species were *Pultenaea scabra, P. muelleri, Cassinia aculeata, Helichrysum ferrugineum* and *Acacia mucronata*. Some tussocks of *Lepidosperma* and *Gahnia* were also present. The ground layer was discontinuous and consisted of *Drosera, Halorrhagis, Viola* and a few tussocks of *Poa australis*.

Here also the soils were red or grey friable loams.

Results:

0-2": 92 seedlings/square foot.

Composition %: *Cassinia aculeata* 49·1%, *Viola hederacea* 7·2%, *Opercularia varia* 7·5%, *Gnaphalium japonicum* 5·2%, *Deyeuxia* sp. 5·2%, *Xanthosia dissecta* 3·7%, *Acrotriche serrulata* 2·3%, *Poa australis* 2·3%, *Helichrysum ferrugineum* 2·3%. <2% (*Oxalis corniculata, Juncus bufonious, Hydrocotyle hirta, Erigeron canadensis, Drosera auriculata, Senecio quadridentatus, S. lautus, Hypochoeris radicata, Pultenaea gunnii, Amperea ziphoclada*).

2-4": 34 seedlings/square foot.

Composition %: *Cassinia* 58·0%, *Xanthosia* 7·4%, *Poa* 7·3%, *Opercularia* 7·3%, *Viola* 6·7%, *Gnaphalium* 6·6%, *Microlaena* 3·4%, Unknown Epacrid 3·3%.

Ferns: *Histiopteris incisa*

Bryophytes: *Riccia* sp., *Anthoceros sp., Bryum truncorum, Funaria gracilis.*

Dry Sclerophyll Forest—Chiltern.

(Workers: Estelle M. Canning and Jeanette M. Boer).

Soil was collected at a site 2-3 miles from Springhurst in north central Victoria. Soils had formed on a granite bedrock and were grey brown gravelly loams.

Standing vegetation was dominated by *E. tereticornis* and *E. macrorrhyncha* with some *Acacia melanoxylon*. In the shrub layer the dominant species was *Brachyloma daphnoides* with some *Hibbertia stricta* and *Indigofera australis*. There was a fairly continuous grassy field layer with annuals such as *Aira, Agrostis avenacea, Vulpia bromoides* and *Bromus sterilis* as the dominants, and some herbaceous dicots, e.g. *Trifolium, Halorrhagis, Ranunculus,* etc.

Results:

In the early stages of the experiment monocotyledons germinated in such great numbers that they had to be removed before identified sufficiently and the results for grasses and sedges have therefore been quoted as a whole. "Grasses and sedges" include the following species: *Aira caryophyllea, Agrostis avenacea, Briza minor, Bromus sterilis, Juncus bufonius, J. capitatus, Scirpus antarcticus* and *Vulpia bromoides. Aira* and *Agrostis* were the most common grasses.

0-2": 1143 seedlings/square foot.

Composition %: Grasses and sedges 53·0%, *Centaurium* (Erythraea) *australis* 12·2%, *Moenchia erecta* 10·6%, *Crassula sieberiana* 6·1%, *Trifolium arvense* 4·1%, *Hypochoeris radicata* 3·8%, *Hypericum* sp. 2·3%, *Hydrocotyle capillaris* 2·0%. <2% (*Linaria pelisseriana, Drosera auriculata, Wahlenbergia quadrifida, Galium parisiense* var. *australe, Halorrhagis tetragyna, H. elata, Stuartina muelleri, Helipterum demissum, Sagina apetala, Anagallis arvense, Prasophyllum* sp., *Brachyloma daphnoides, Oxalis corniculata, E. tereticornis, Epilobium glabellum.*

2-4": 220 seedlings/square foot.

Composition %: Grasses and sedges 57·7%, *Centaurium* 16·4%, *Crassula* 5·2%, *Moenchia* 5·2%, *Trifolium* 3·6%, *Hypochoeris* 3·4%, *Linaria* 2·5%, *Hypericum* 2·2%. <2% (*Hydrocotyle, Drosera, Lythrum, Anagallis, Sagina, Halorrhagis, Stuartina*).

Ferns: *Cheilanthes tenuifolia*

Bryophytes: *Riccia* sp., *Anthoceros* sp., *Bryum agrenteum, B. dichotomum, Triquetrella papillata, Campylopus clavatus, Barbula australasicae.*

Red Gum Woodland—Yan Yean.

(Workers: R. N. Webb and F. Ingerswen)

Soils were collected from ungrazed land near Yan Yean. The vegetation was an open red gum woodland (*E. camaldulensis*) with a few large red gum and a dense grass ground layer. In this area many young red gum have regenerated due to protection from grazing.

The soil is a grey clay developed on basalt. The hummocks and hollows of a gilgai structure have developed on these soils, but its effect on the vegetation was not noted. The variability of the results could be due to the variation of the vegetation on these soils, and to the proximity of the sites to the old red gums.

Results:

0-2": 2,303 seedlings/square foot.

Composition %: *Anthoxanthum odoratum* 19·6%, *Juncus capitatus* 13·6%, *Centaurium* (*Erythraea*) *australis* 13·4%, *Juncus bufonius* 10·9%, *Scirpus antarcticus* 9·9%, *Cyperus tenellus* 6·9%, *Romulea rosea* 4·4%, *Plantago lanceolata* 3·4%, *Briza minor*

3·3%, *Hypericum sp.* 2·9%, *Juncus* sp. (perennial) 2·7%. <2% (*Themeda australis, Hypochoeris* sp., *Trifolium glomeratum, T. dubium, T. repens, Oxalis corniculatus, Agrostis avenacea, Drosera auriculata, Sonchus aspera, Gnaphalium japonicum, Crassula sieberiana, Taraxacum officinale, Lolium perenne, Holcus lanatus, Aira caryophyllea, Sporobolus indicus, Cerastium* sp., *Sagina apetala, Carex inversa, Lobelia pratinoides, Epilobium glabellum, Lythrum hyssopifolium, Microlaena stipoides, Aster squamatus, Centunculus minimus, Bromus sterilis, Vulpia bromoides, Stipa* sp., *Cirsium* sp., *Veronica gracilis, Bromus mollis, Erigeron* sp., *Vicia angustifolia*).

2-4": 548 seedlings/square foot.

Composition %: *Juncus cap.* 30·9%, *J. bufonius* 14·6%, *Scirpus antarcticus* 13·2%, *Cyperus tenellus* 9·4%, *Anthoxanthum* 5·8%, *Plantago* 4·3%, *Cerastium* 4·2%, *Centaurium* 3·4%, *Juncus pauciflorus* 2·7%, *Romulea* 2·4%, *Briza* 2·0%. <2% (*Trifolium glomeratum* + *T. dubium, Gnaphalium, Hypericum, Medicago* sp., *Agrostis, Bromus mollis, Sonchus, Oxalis, Crassula, Vulpia, Bromus sterilis, Carex, Aira, Microlaena, Trifolium repens, Aster, Lolium, Sporobolus, Cirsium*).

Ferns: *Cheilanthes tenuifolia*

Bryophytes: *Riccia sp., Fossombronia* sp., *Funaria gracilis, F. hygrometrica.*

Red Gum Woodland—You Yangs.

(Workers: P. Lawson and R. Smith)

Soil was collected from a forest reserve at the You Yangs near Geelong. The soils are gravelly loams formed on granite outwash from the You Yangs.

The vegetation is a savannah woodland. *E. camaldulensis* although mostly confined to water courses in the area, occurred as a regrowth stand in the area chosen for study. The canopy is quite open and beneath it are the shrubs *Acacia pycnantha* and *A. decurrens* with occasional *Exocarpos* and *Casuarina stricta*. The ground cover is dominantly grassy with *Briza maxima* and *Danthonia* as the most common grasses. There are many annual dicot herbs. *Hypochoeris radicata* and *Halorrhagis* are also common.

Results:

0-2": 2,953 seedlings/square foot.

Composition %: *Scirpus antarcticus* 36·7%, *Lythrum hyssopifolium* 19·1%, *Centrolepis fascicularis* 7·1%, *Juncus bufonius* 7·4%, *J. capitatus* 7·1%, *Anagallis arvensis* 4·7%, *Hypericum japonicum* 4·5%, *Crassula recurva* 3·0%, *Gnaphalium luteoalbum* 2·7%. <2% (*Centaurium australis, Agrostis avenacea, Stuartina muelleri, Juncus planifolius, J. subsecundus, Centunculus minima, Schoenus latelaminatus, Cyperus tenellus, Gnaphalium purpureum, Hypochoeris radicata, Gnaphalium candidissimum, G. japonicum, Hallorrhagus elata, Holcus lanatus, Phytolacca octandtra, Calandrinia calyptrata, Oxalis corniculata, Vulpia bromoides, Danthonia caespitosa, Carex inversa, Briza minor, Toxanthus muelleri, Helipterum australe, Rumex brownii, Limosella aquatica, Wahlenbergia* sp., *Leptorhynchus tenuifolius, Prostanthera nivea, Aira caryophyllea, Drosera peltata, Acacia implexa*).

2-4": 378 seedlings/square foot.

Composition %: *Scirpus* 50·3%, *Lythrum* 13·1%, *Juncus capitatus* 11·0%, *Centaurium* 3·7%, *Centrolepis* 3·5%, *Juncus subsecundus* 3·5%, *Anagallis* 3·1%, *Hypericum* 2·7%, *Juncus bufonius* 2·3%. <2% (*Vulpia, Crassula, Gnaphalium luteoalbum, Prostanthera, Phytolacca, Agrostis, Gnaphalium japonicum, Centunculus,*

Danthonia, Cyperus, Oxalis, Limosella, Stuartina, Solanum sp., *Helipterum, Galium, Gnaphalium purpureum*).

Ferns: *Cheilanthes tenuifolia*

Bryophytes: *Riccia* sp., *Triquetrella papillata, Bryum dichotomum.*

Heath—Cranbourne.

(Workers: Georgina H. Zammit and Suzanne B. Ridgway)

Soils were collected from a northerly slope at an altitude of about 45 ft. near Cranbourne. The vegetation was characteristic of the coastal heaths in the area with occasional manna gums (*E. viminalis*). Most common shrubs of the area are *Leptospermum myrsinoides, Epacris, Dillwynia, Hakea* and *Banksia*. There is a sparse ground cover of *Hypolaena fastigiata, Juncus* spp., *Poa* and various orchids and composites.

Soils were grey and yellow sands from the soil type known as Cranbourne sand, a sandy podzol.

Results:

0-2": 36 seedlings/square foot.

Composition %: *Monotoca* + *Leucopogon* 29·1%, *Oxalis corniculata* 15·9%, *Hypolaena fastigiata* 12·5%, *Leptospermum myrsinoides* 12·1%, *Caesia parviflora* 8·5%, *Hydrocotyle capillaris* 3·6%, *Opercularia varia* 3·6%, *Juncus* sp. (perennial) 2·4%, *Schoenus* sp. 2·4%, *Juncus bufonius* 2·4%, *Scirpus antarcticus* 2·4%. <2% (*Comesperma calymega, Dillwynia* sp., *Danthonia eriantha, Hibbertia* sp., *Leptospermum laevigatum*).

2-4": 26 seedlings/square foot.

Composition %: *Monotoca* + *Leucopogon* 25·8%, *Scirpus antarcticus* 14·7%, *Comesperma* 12·8%, *Wahlenbergia* sp. 9·4%, *Hypolaena* 5·6%, *Leptospermum myrsinoides* 5·6%, *Juncus bufonius* 5·6%, *Erigeron* sp. 5·6%, *Hydrocotyle* 3·7%, *Dillwynia* 3·7%, *Danthonia* 3·7%. <2% (*Caesia, Centrolepis* sp.)

Bryophytes: *Bryum truncorum, B. dichotomum.*

Mallee—Mildura.

(Workers: D. J. Groot Obbink and S. Y. S. Zee)

Soils were collected at a site about half a mile west of Mildura airport. The soil was a red sandy loam developed on sand hill country. Some of the area showed marked salt accumulation and one sample chosen was on a salt scalded patch. Results from this sample were not included.

The vegetation is dominated by oil mallee (*E. oleosa*) with some *Callitris verrucosa*. The shrub layer included *Calocephalus sonderi, Atriplex muelleri, Zygophyllum apiculatum* and *Rhagodia nutans.*

Results:

0-2": 422 seedlings/square foot.

Composition %: *Crassula sieberiana* 43·6%, *Mesembryanthemum crystallinum* 35·5%, *Nicotiana glauca* 3·7%, *Zygophyllum apiculatum* 3·7%, *Asphodelus fistulosus* 3·4%, *Schismus calycinus* 2·6%. <2% (*Rhagodia nutans, Centipeda cunninghamii,* unidentified monocot, *Calocephalus sonderi, Atriplex muelleri, A. campanulata, Geococcus pusillis, Chenopodium cristatum, Tetragona expansa, Erodium cicutarium, Sisymbrium officinale, Trisetum pumilium, Juncus subsecundus*).

2-4": 150 seedlings/square foot.

Composition %: *Mesembryanthemum* 33·3%, *Crassula* 24·0%, *Asphodelus* 7·8%, *Schismus* 7·0%, *Zygophyllum* 7·0%, *Nicotiana* 7·0%, *Calocephalus* 6·1%, *Rhagodia* 3·6%, *Centipida* 2·0%. <2% *Geococcus, Erodium cicutarium.*

Bryophytes: *Riccia* spp., *Anthoceros* sp., *Bryum argenteum, B. dichotomum, Ditrichum flexifolium, Funaria gracilis.*